

Development of Modified Zeolite for Treatment of Grey Water into a Source of Irrigation Water for Plants

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Abstract. The rising demand for clean water in urban areas, coupled with diminishing surface water resources, highlights the urgency of sustainable management strategies. Grey water, constituting 70–75% of domestic wastewater, contains nutrients, heavy metals, surfactants, and emerging contaminants (ECs) such as pharmaceuticals and pesticides, which are resistant to conventional treatment. Its uncontrolled discharge contributes significantly to river pollution and poses risks to environmental and public health. This study introduces a low-cost, eco-friendly treatment system using modified zeolite filtration media. Three variants were developed: surfactant-modified zeolite (SMZ) with CTAB, Fe-impregnated zeolite (MeO-Z), and biochar–zeolite composite (BZC), designed to enhance adsorption of cations, anions, organics, and pathogens. The methodology includes zeolite preparation, physicochemical characterization, grey water sampling, batch optimization, and continuous column tests. Adsorption isotherm and kinetic models assess performance. The system offers resource efficiency, low operational cost, reusability, and by-product avoidance, enabling safe non-potable reuse while reducing pollutant loads in urban water cycles.

Keywords: Greywater, Modified Zeolite, Filtration, Emerging Contaminants